

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
27 June 2002 (27.06.2002)

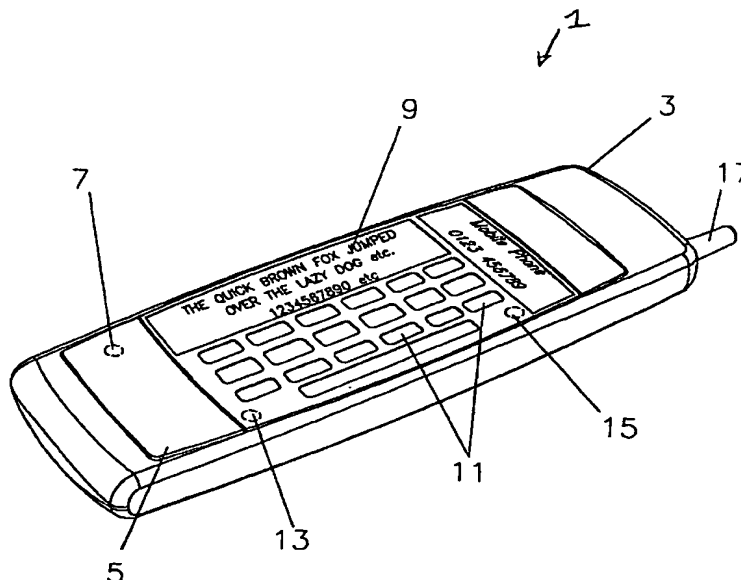
PCT

(10) International Publication Number
WO 02/51201 A2

- (51) International Patent Classification⁷: **H04R 7/04** (74) Agent: **MAGUIRE BOSS**, 5 Crown Street, St. Ives, Cambridgeshire PE27 5EB (GB).
- (21) International Application Number: **PCT/GB01/05608**
- (22) International Filing Date:
19 December 2001 (19.12.2001)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
0031246.2 20 December 2000 (20.12.2000) GB
- (71) Applicant (for all designated States except US): **NEW TRANSDUCERS LIMITED** [GB/GB]; 37 Ixworth Place, London SW3 3QH (GB).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **BOWN, Russ** [GB/GB]; New Transducers Limited, Cygnet House, Kingfisher Way, Hinchingsbrooke Business Park, Huntingdon, Cambridgeshire PE29 6FW (GB).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:
— without international search report and to be republished upon receipt of that report

[Continued on next page]

(54) Title: MULTI-FUNCTIONAL VIBRO-ACOUSTIC DEVICE



(57) Abstract: Apparatus (1) comprising a bending wave panel loudspeaker having a bending wave panel (5) defining a surface and an electro-acoustic transducer (15) attached to the bending wave panel to excite bending waves in the panel to produce an acoustic output, an input device (11) forming part of the surface and means (13) for providing force-feedback to the input device. The panel provides several functions and may be considered to be a hyper-functional surface (HFS).

WO 02/51201 A2

WO 02/51201 A2



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

5 TITLE: MULTI-FUNCTIONAL VIBRO-ACOUSTIC DEVICE

DESCRIPTION

10 TECHNICAL FIELD

 This invention relates to apparatus which combines a vibro-acoustic device with other sensors and additional functionality.

BACKGROUND ART

15 Bending wave or distributed mode loudspeakers (DML) are described in International application WO97/09842 and other documents in the name New Transducers Ltd. Such loudspeakers may be used in applications where the loudspeaker element has additional functionality. For
20 example, International applications WO97/09843, WO97/09853 and WO01/31971 describe the use of such panels as a ceiling tile, in a projection screen and in a keyboard, respectively.

 Furthermore, applications of DML technology have
25 extended to the use of both opaque and transparent loudspeaker panels incorporating touch-sensitive capability. For example International application WO00/54548 describes electronic apparatus incorporating a loudspeaker having a bending wave panel member with a

user-accessible surface, an electro-acoustic vibration exciter on the panel member to introduce bending wave energy into the panel member in response to an electrical signal applied thereto, and at least one touch sensitive area on or associated with the said user-accessible surface and responsive to user contact. International application WO01/48684 describes a contact sensitive device comprising a transparent touch sensitive plate mounted in front of a display device.

It is an object of the present invention to extend the use of acoustic radiating surfaces beyond touch-sensitivity to include other sensory functions. The principle may be applied equally well to both bending wave loudspeakers (e.g. DML) as well as pistonic acoustic radiators.

DISCLOSURE OF INVENTION

According to the invention there is provided apparatus comprising a bending wave panel loudspeaker having a bending wave panel defining a surface and an electro-acoustic transducer attached to the bending wave panel to generate bending waves in the panel to produce an acoustic output, an input device forming part of the surface and means for providing force-feedback to the input device.

Thus the apparatus combines loudspeaker and force feedback facility into the same surface. The transducer may excite the panel to cause it to emit sound at a variety of volumes. The volume of sound output may be

adjusted via the input device depending on the application and thus provides a multi-functional loudspeaker. For example, the loudspeaker may be used in conference mode as a hands-free loudspeaker telephone or in telephone mode to
5 be held to a user's ear. The panel may function as a ringer loudspeaker, and/or vibration transducer for mobile 'phones, pagers etc. The force feedback facility is otherwise known as haptics.

The input device may be a touch sensitive input
10 device or a keyboard. The means for providing force feedback may be in the form of a second transducer mounted to the panel which provide pulses to the panel. The pulses may be in the form of a transient spike signal whereby a button click sensation is provided.
15 Alternatively, a single dual function transducer may generate both acoustic output and force feedback. Alternatively, passive force feedback may be achieved by mounting the panel around its perimeter on non-linearly deflecting panel mounts which provide the sensation of a
20 button-click when depressing a portion of the panel. Regions of the input device may be locally heated to provide tactile feedback.

The apparatus may comprise a visual display device associated with the bending wave panel. The visual display
25 device may be in the form of a conventional display surface such as a liquid crystal display (LCD) panel. At least a part of the panel may be transparent and the visual display device may be mounted behind the

transparent part of the panel and thus the panel may act as a transparent display window. Alternatively, the panel may also act as the display, for example by application of a light-emitting surface finish comprising light emitting polymers or pigments. Thus, the number of components in the device may be reduced without loss of versatility or functionality.

Other functions may be provided. The panel may function as a microphone and/or loudspeaker. Alternatively, one or more microphones may be attached to the panel or the casing of the device. Any one of the following items may be attached to the panel or the casing, namely a stills or video camera, heating and/or cooling elements and a variety of other sensors, e.g. chemical composition, electrical sensors, light-meters etc.

Chromatic characteristics may be included in the panel, such as passive chromatic finishes, e.g. anti-glare or mirrored finishes. Alternatively or additionally, active chromatics may be provided, such as photo-chromatics or thermo-chromatics. The panel may have surface textures and/or variable surface contours.

A wide range of acoustic and other sensory functions may be simultaneously integrated into the panel. Thus the panel may be termed a hyper functional surface (HFS) since it is a single component assembly which may provide an increased number of functional synergies. The functions provided by the panel may be selected from any

one of the functions mentioned above. For example, by using a transparent, touch-sensitive panel with force feedback facility, apparatus may be obtained which may be used to view information, hear acoustic signals (messages, bleeps, clicks etc) and feel simulated button clicks through one's fingertips.

One advantage of the apparatus may be that by using a touch sensitive panel the need for a separate keypad may be eliminated. This may be particularly useful in small electronic articles, for example hand-held devices, which have limited space for components. In certain applications (e.g. communications and computing), the size or bulk of devices and hence their internal volume in which individual components are housed is reducing and is tending towards zero. The usefulness of such devices may therefore be expressed in terms of their functionality per unit surface area. The invention anticipates this trend and offers a designer a way to maximise the range of sensory options for any given surface.

The apparatus according to the invention may reduce the surface area required to provide a plurality of functions. The invention may be considered to relate to the amalgamation of a vibro-acoustic device with other sensory features and functionality which results in significant benefits for the manufacture and use of such apparatuses which may be termed human machine interfaces (HMI).

Such multiple combinations would be more difficult using conventional loudspeakers. Mounting keypads, displays etc on the cone of a conventional loudspeaker is likely to interfere with the function of the cone.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described, purely by way of example, with reference to the accompanying drawings.

Figure 1 shows a perspective view of a personal data
10 assistant (PDA) according to the invention;

Figure 2 shows a plan view of a handheld multi-channel player according to the invention;

Figure 3 is a cross-sectional view of a section of a keyboard which may be used in either the personal data
15 assistant of Figure 1 or the handheld player of Figure 2, and

Figure 4 is a cross-sectional view of a section of an alternative keyboard which may be used in either the personal data assistant of Figure 1 or the handheld player
20 of Figure 2.

BEST MODES FOR CARRYING OUT THE INVENTION

Figure 1 shows apparatus according to the invention in the form of a smart-phone or personal data assistant (PDA) 1 having a casing 3 and an input device in the form
25 of a touch sensitive panel 5. The panel is of the appropriate thickness and moderate mechanical impedance to be set into bending wave vibration for several vibro-acoustic purposes. The panel is made from a transparent

material allowing a liquid crystal display (LCD) 9 which is mounted behind the panel to be viewed.

The panel acts as a loudspeaker and is capable of supporting bending waves. A first transducer 15 is mounted to the panel to excite bending wave vibration in the panel to produce an acoustic output. The volume of the acoustic output may be adjusted allowing the PDA to be used in conference mode as a hands-free loudspeaker telephone or in telephone mode to be held to a user's ear.

A second exciter 13 is also mounted on the panel to provide pulses to the panel when a key is depressed and hence provide haptics or tactile feedback. A single dual function transducer may be provided which provides both the loudspeaker and feedback functionality. The dual function transducer, or either of the first or second transducers, may also be energisable in the body perceived band around 80Hz to provide silent signalling of a call. Thus, the panel acts a multi-mode loudspeaker, for example, as a telephone ear-piece, a hands-free speaker or a ringer.

The panel 5 also functions as a keypad or keyboard. Individual keys 11 of the keypad may appear on the display mounted underneath the panel or alternatively the keys may be marked on its surface. A microphone transducer 7 is also fixed to the panel whereby the panel may function as a microphone. Alternatively, one or more microphones may be attached to the panel or the casing allowing sound capture and localisation for sound reproduction when in

conference or video mode.

A mobile communications aerial 17 and associated conventional mobile telephony circuitry (not shown) allows the device to function as a mobile telephone or to send
5 and receive messages or video material. Images may be captured using an embedded video camera.

As outlined above the panel provides several functions and may be considered to be a hyper-functional surface (HFS). The apparatus has a simple construction and
10 performs the function of many distinct devices each of which use the panel (as HFS) as a user's main interface medium.

Figure 2 shows an alternative apparatus according to the invention in the form of a handheld multi-channel
15 player 21 having a casing 23 and a panel 25. The panel 25 is divided into several regions each providing separate functions, for example loudspeaker, input and/or display functions.

The panel has three loudspeaker regions which provide
20 left, right and centre channels 31, 33, 35 respectively. At least one transducer (not shown) is mounted to each panel region to excite bending wave vibration in the panel to produce an acoustic output. When a disc 29 is inserted into the player 21 as indicated, the panel 25 may
25 reproduce multi-channel information stored on the disc.

A video display area 37 is mounted behind a transparent region of the panel 25. The display area 37 may display information from the disc 29 or alternatively

may display information inputted to the device by a user on a keyboard region 27 of the panel 25. The keyboard region 27 includes several keys 39 marked on the surface of the panel 25. The keys 39 are configured to provide
5 haptics or tactile feedback, for example by providing a transducer as described in Figure 1.

Alternatively, haptics or tactile feedback may be provided in either the apparatus of Figure 1 or Figure 2 by the mechanism shown in Figure 3. In Figure 3, a panel
10 41 is mounted by a mechanical reflex element 45 to a frame 43 having a generally L-shaped cross-section. The reflex elements are similar to those used in some keyboards. Each mechanical reflex element 45 (only one is shown) comprises an upper pad 47 mounted to the panel 41 and a
15 lower pad 49 touching the upper pad 47, the lower pad 49 being mounted on a mounting block 51 which is attached to the frame 43. The upper and lower pads 47,49 are both dome-shaped and made of flexible material. A pair of springs 53 also connects the mounting block 51 to the
20 panel 41. The deflection of the pads 47, 49 in conjunction with the rest of the reflex element 45 is non-linear. The reflex elements 45 are spaced such that, taking panel bending stiffness into account, unambiguous activation (deflection) of at least one reflex element is
25 ensured. Since the reflex elements are designed to provide tactile feedback, it is important that at least one reflex element local to the point of application of force be activated.

When a user exerts pressure on the panel 41 in the direction of the arrow 55, at least some of the mechanical reflex elements 45 are compressed and due, to the resilient nature of the elements, a return force is exerted on the panel 41 which is sensed by the user. Thus, force feedback and a sensation of a button-click is provided when a portion of the panel is pressed or engaged.

Figure 4 shows a panel 61 which may be the panel of apparatus shown in Figure 1 or Figure 2. The panel 61 is mounted in a frame 43 by means of a suspension 63 which extends around the perimeter of the panel 61. The suspension 63 may be resilient. The suspension 63 may wholly or partially clamp the panel 61. The frame 43 has a generally L-shaped cross-section. An image module 65, for example a charge coupled device (CCD) image module, is mounted on the frame 43 behind the panel 61 whereby the image module 65 is integrated into apparatus according to the invention. The image module 65 captures still or video images and is connected to an image processor (not shown) by wires 67.

As in the apparatus of Figure 1, haptics is provided by a transducer 69 mounted to the panel 61. The transducer 69 excites bending waves in the panel 61 to provide pulses to the panel 61 when a key is depressed. The panel comprises chromatic characteristics in the form of a semi-reflecting chromatic layer 71 which is optional.

It will be appreciated that the apparatus shown may

be adapted to function as a computer, communicator, web TV, videophone, camcorder, dictaphone, organiser, augmented reality window, GPS/navigator, game and/or wearable fashion accessory. The apparatus may further
5 comprise viewing apparatus for 3-D image perception or additional sound sources for reproducing extra audio channels, e.g. rear channels and a sub-woofer.

The invention may be consider to unlock a large number of new device options which may be expressed as
10 the total number of combinations of each of the separate sensory functions in conjunction with any or all of the other functions. By adapting the combination of functions, the invention may have application in each of the following fields: -

- 15 a) control surfaces in all consumer/industrial applications (including displays or product housings),
- b) telephones, including mobile or fixed telephones, intercoms, pagers, or videophones,
- c) multimedia devices, including laptops or personal data
20 assistants (PDAs),
- d) electronic goods, including portable music or video players and recorders, dictaphones, toys, games, cameras, video cameras, televisions, 3D televisions, virtual reality devices, augmented reality devices or video-on
25 demand devices
- e) other goods, e.g. white or brown goods, medical devices, clothing, badges, labelling, novelty and greetings products, credit cards or smart cards

f) in architectural applications, e.g. furniture or office equipment

g) in other applications, e.g. art or defence.

CLAIMS

1. Apparatus comprising a bending wave panel loudspeaker having a bending wave panel defining a surface and an electro-acoustic transducer attached to the bending wave panel to excite bending waves in the panel to produce an acoustic output, an input device forming part of the surface and means for providing force-feedback to the input device.
2. Apparatus according to claim 1, wherein the means for providing force-feedback is in the form of a second transducer mounted to the panel which provide pulses to the panel.
3. Apparatus according to claim 1, wherein the transducer generates both acoustic output and force feedback, the force feedback being in the form of pulses to the panel.
4. Apparatus according to claim 2 or claim 3, wherein the pulses are in the form of a transient spike signal whereby a button click sensation is provided.
5. Apparatus according to claim 1, wherein the means for providing force-feedback is in the form of non-linearly deflecting panel mounts by which the panel is mounted to the apparatus, the mounts producing a sensation of a button-click when a portion of the panel is pressed.
6. Apparatus according to any one of the preceding claims, wherein regions of the input device are locally heated to provide tactile feedback.
7. Apparatus according to any preceding claim,

comprising a visual display device associated with the bending wave panel.

8. Apparatus according to claim 7, wherein at least a part of the panel is transparent and the visual display
5 device is mounted behind the transparent part of the panel.

9. Apparatus according to claim 7, wherein the panel comprises an integral visual display device.

10. Apparatus according to any preceding claim, wherein
10 the panel functions as a microphone.

11. Apparatus according to any preceding claim, comprising a stills or video camera located behind the panel.

12. Apparatus according to the preceding claim, wherein
15 the panel comprises chromatic characteristics.

13. Apparatus according to any preceding claim, wherein the acoustic output of the loudspeaker is adjustable via the input device.

14. Apparatus according to any preceding claim,
20 comprising a multi-media player having mono, stereo or multi-channel sound.

15. Apparatus according to any preceding claim, wherein the input device is a touch sensitive input device.

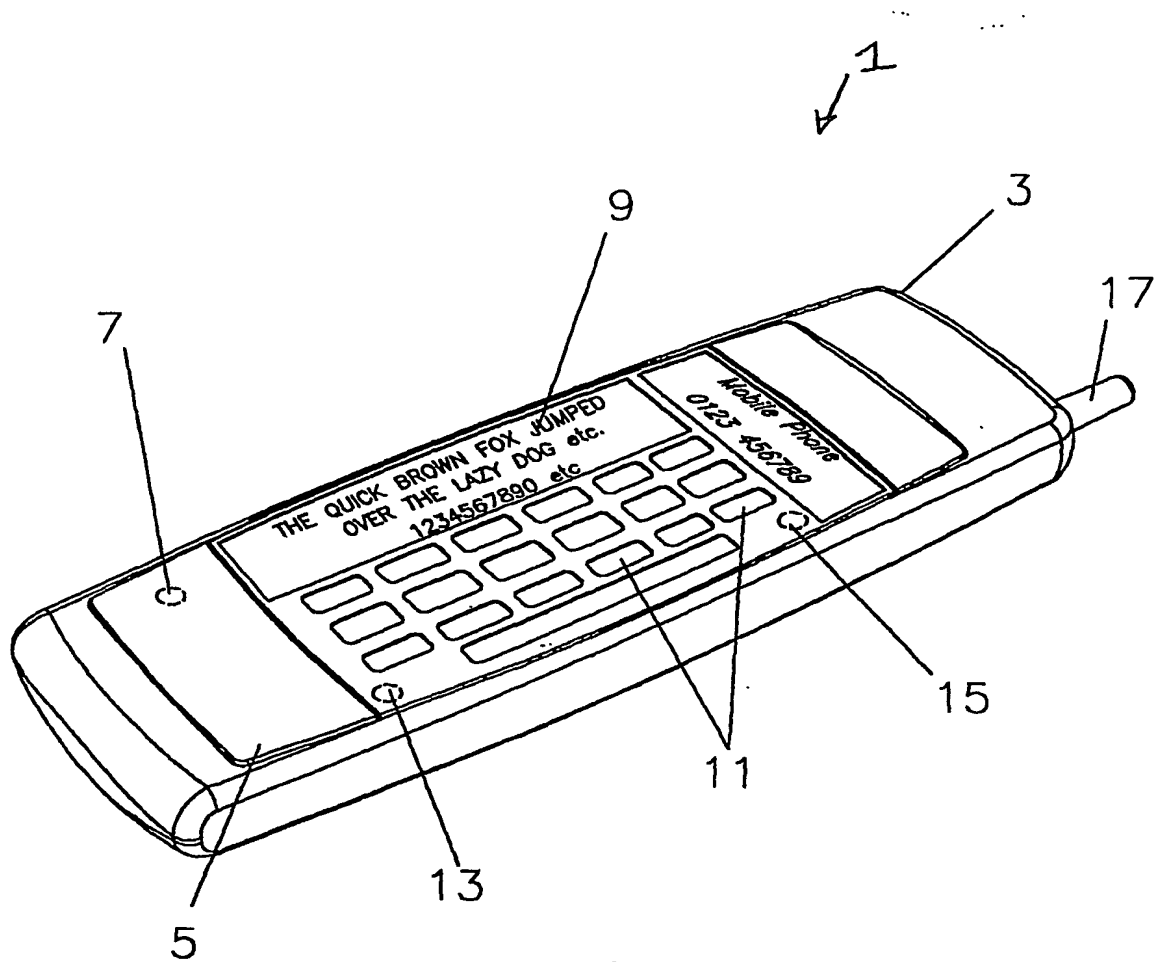


FIG 1

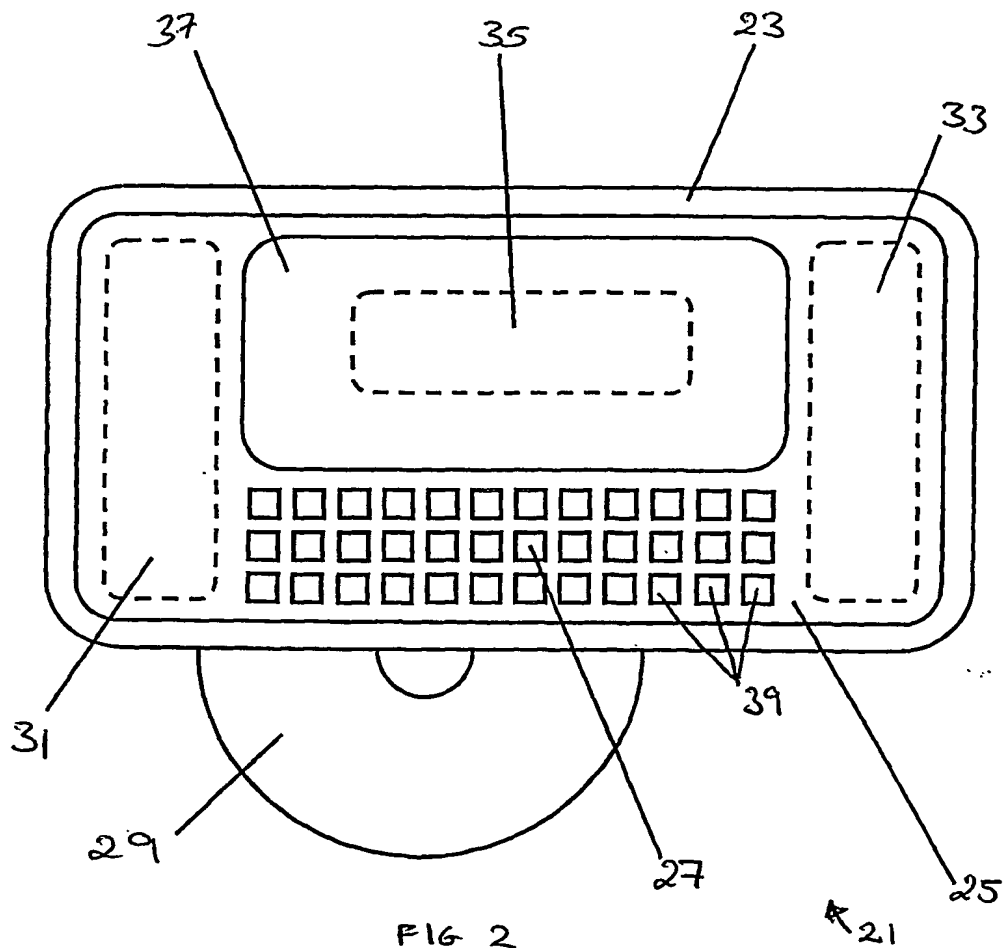
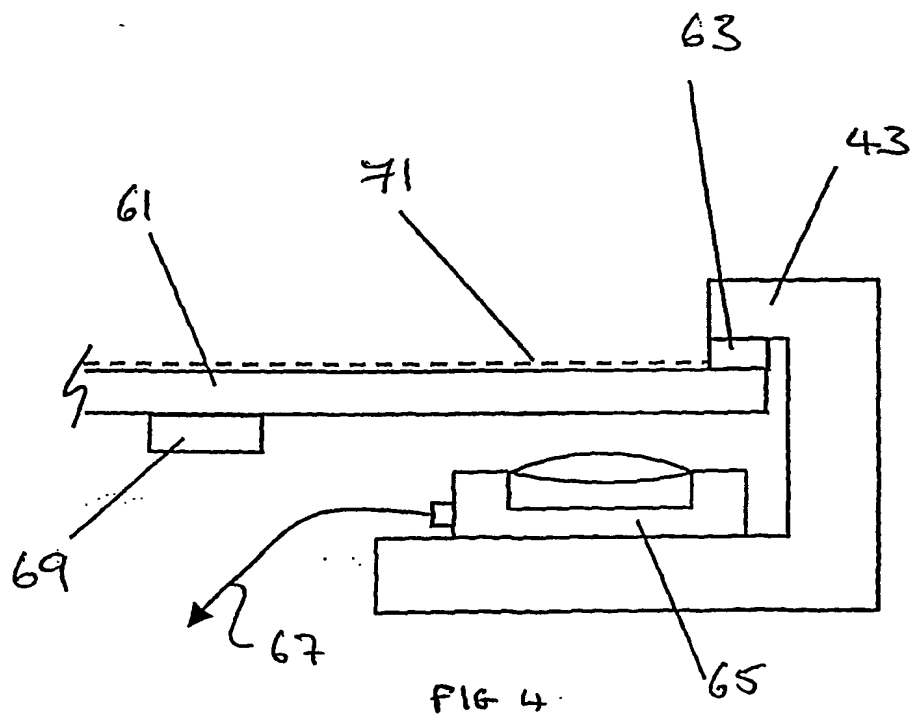
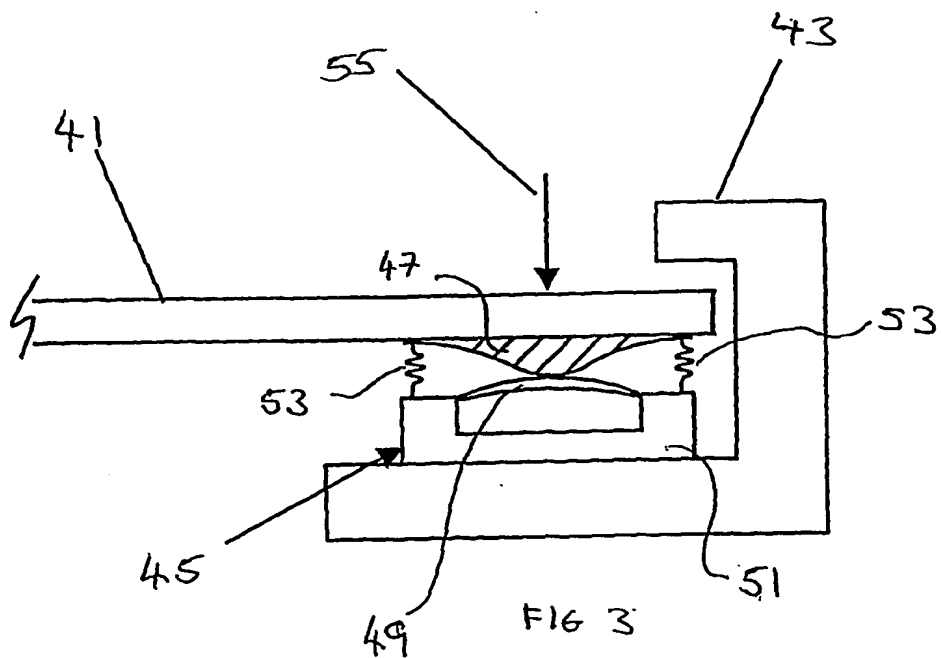


FIG 2



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
27 June 2002 (27.06.2002)

PCT

(10) International Publication Number
WO 2002/051201 A3

(51) International Patent Classification⁷: **H04R 7/04**,
G06K 11/14, G10K 11/00, 15/04

(74) Agent: MAGUIRE BOSS; 5 Crown Street, St. Ives, Cam-
bridgeshire PE27 5EB (GB).

(21) International Application Number:
PCT/GB2001/005608

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG,
SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ,
VN, YU, ZA, ZM, ZW.

(22) International Filing Date:
19 December 2001 (19.12.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0031246.2 20 December 2000 (20.12.2000) GB

(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR,
GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent
(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR,
NE, SN, TD, TG).

(71) Applicant (*for all designated States except US*): NEW
TRANSDUCERS LIMITED [GB/GB]; 37 Ixworth Place,
London SW3 3QH (GB).

(72) Inventor; and

(75) Inventor/Applicant (*for US only*): BOWN, Russ
[GB/GB]; New Transducers Limited, Cygnet House,
Kingfisher Way, Hinchingsbrooke Business Park, Hunting-
don, Cambridgeshire PE29 6FW (GB).

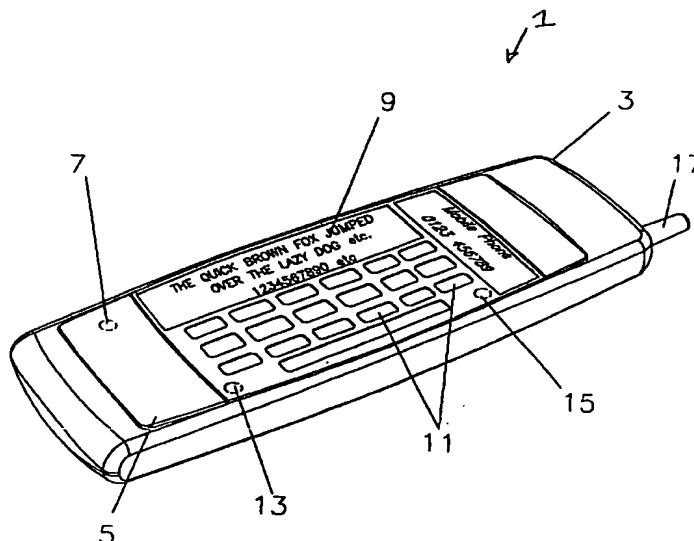
Published:

— with international search report

(88) Date of publication of the international search report:
31 December 2003

[Continued on next page]

(54) Title: MULTI-FUNCTIONAL VIBRO-ACOUSTIC DEVICE



(57) Abstract: Apparatus (1) comprising a bending wave panel loudspeaker having a bending wave panel (5) defining a surface and an electro-acoustic transducer (15) attached to the bending wave panel to excite bending waves in the panel to produce an acoustic output, an input device (11) forming part of the surface and means (13) for providing force-feedback to the input device. The panel provides several functions and may be considered to be a hyper-functional surface (HFS).

WO 2002/051201 A3



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 01/05608

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04R7/04 G06K11/14 G10K11/00 G10K15/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04R G06K G10K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 00 02417 A (NEW TRANSDUCERS LTD ;AZIMA HENRY (GB); MORECROFT DENIS (GB)) 13 January 2000 (2000-01-13) page 2, line 17 -page 4, line 2 page 5, line 25 -page 8, line 14 page 11, line 14 -page 12, line 24 page 14, line 25 -page 15, line 17 page 15, line 25 -page 17, line 8 figures 3,4,8,9,11-16 ---	1-5,7-15
Y	WO 00 54548 A (NEW TRANSDUCERS LTD ;AZIMA HENRY (GB)) 14 September 2000 (2000-09-14) page 5, line 4 -page 7, line 2 ---	1-5,7-15
Y	US 5 977 867 A (BLOUIN FRANCOIS) 2 November 1999 (1999-11-02) abstract ----- -/-	1-4,7-15



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

* & * document member of the same patent family

Date of the actual completion of the international search

4 February 2003

Date of mailing of the international search report

18/02/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Nieuwenhuis, P

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/05608

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 43 23 863 A (ANDROMEDA GES FUER COMPUTER UN) 19 January 1995 (1995-01-19) column 1, line 3 - line 57 -----	1-4,7-15
Y	US 6 118 435 A (KAWAKAMI MASAHIKO ET AL) 12 September 2000 (2000-09-12) column 16, line 57 -column 17, line 12; figures 7,8 -----	1-5,7-15
A	WO 97 09842 A (AZIMA HENRY ;HARRIS NEIL (GB); COLLOMS MARTIN (GB); VERITY GROUP P) 13 March 1997 (1997-03-13) cited in the application page 77, line 1 -page 78, line 29; figures 47-49 -----	10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 01/05608

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0002417	A	13-01-2000	AU 754818 B2 28-11-2002
			AU 4520599 A 24-01-2000
			BG 105047 A 31-12-2001
			BR 9911818 A 27-03-2001
			CA 2336271 A1 13-01-2000
			CN 1307791 T 08-08-2001
			EP 1084592 A1 21-03-2001
			WO 0002417 A1 13-01-2000
			HU 0103957 A2 28-03-2002
			JP 2002533957 T 08-10-2002
			NO 20010005 A 28-02-2001
			NZ 508511 A 28-03-2002
			PL 345317 A1 03-12-2001
			SK 20292000 A3 11-06-2001
			TR 200100136 T2 21-06-2001
			US 2001026625 A1 04-10-2001
			AU 745830 B2 11-04-2002
			AU 2926500 A 28-09-2000
			BR 0008726 A 26-12-2001
			CN 1342383 T 27-03-2002
			CZ 20013052 A3 16-01-2002
			EP 1159852 A2 05-12-2001
			WO 0054548 A2 14-09-2000
			HU 0200228 A2 29-05-2002
			JP 2002539698 T 19-11-2002
			NO 20014285 A 04-09-2001
			SK 12432001 A3 03-12-2001
			TR 200102543 T2 21-03-2002
			TW 472496 B 11-01-2002
			US 6342831 B1 29-01-2002
WO 0054548	A	14-09-2000	AU 745830 B2 11-04-2002
			AU 2926500 A 28-09-2000
			AU 754818 B2 28-11-2002
			AU 4520599 A 24-01-2000
			BG 105047 A 31-12-2001
			BR 0008726 A 26-12-2001
			BR 9911818 A 27-03-2001
			CA 2336271 A1 13-01-2000
			CN 1342383 T 27-03-2002
			CN 1307791 T 08-08-2001
			CZ 20013052 A3 16-01-2002
			EP 1159852 A2 05-12-2001
			EP 1084592 A1 21-03-2001
			WO 0054548 A2 14-09-2000
			WO 0002417 A1 13-01-2000
			HU 0103957 A2 28-03-2002
			HU 0200228 A2 29-05-2002
			JP 2002533957 T 08-10-2002
			JP 2002539698 T 19-11-2002
			NO 20010005 A 28-02-2001
			NO 20014285 A 04-09-2001
			NZ 508511 A 28-03-2002
			PL 345317 A1 03-12-2001
			SK 12432001 A3 03-12-2001
			SK 20292000 A3 11-06-2001
			TR 200100136 T2 21-06-2001
			TR 200102543 T2 21-03-2002

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 01/05608

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0054548	A	TW 472496 B	11-01-2002
		US 6342831 B1	29-01-2002
		US 2001026625 A1	04-10-2001
US 5977867	A	02-11-1999	NONE
DE 4323863	A	19-01-1995	DE 4323863 A1 19-01-1995
US 6118435	A	12-09-2000	JP 10289061 A 27-10-1998
		JP 10293644 A	04-11-1998
WO 9709842	A	13-03-1997	AT 177579 T 15-03-1999
		AT 177574 T	15-03-1999
		AT 177580 T	15-03-1999
		AT 177575 T	15-03-1999
		AT 186617 T	15-11-1999
		AT 177581 T	15-03-1999
		AT 177582 T	15-03-1999
		AT 177583 T	15-03-1999
		AT 177578 T	15-03-1999
		AT 177576 T	15-03-1999
		AT 179297 T	15-05-1999
		AT 177577 T	15-03-1999
		AT 179563 T	15-05-1999
		AT 176826 T	15-03-1999
		AT 179045 T	15-04-1999
		AT 179296 T	15-05-1999
		AT 177281 T	15-03-1999
		AT 179564 T	15-05-1999
		AT 177282 T	15-03-1999
		AT 179043 T	15-04-1999
		AT 179044 T	15-04-1999
		AU 702865 B2	11-03-1999
		AU 6880196 A	27-03-1997
		AU 702920 B2	11-03-1999
		AU 6880296 A	27-03-1997
		AU 702867 B2	11-03-1999
		AU 6880396 A	27-03-1997
		AU 703015 B2	11-03-1999
		AU 6880496 A	27-03-1997
		AU 702863 B2	11-03-1999
		AU 6880596 A	27-03-1997
		AU 702873 B2	11-03-1999
		AU 6880696 A	27-03-1997
		AU 702999 B2	11-03-1999
		AU 6880796 A	27-03-1997
		AU 703061 B2	11-03-1999
		AU 6880896 A	27-03-1997
		AU 703000 B2	11-03-1999
		AU 6880996 A	27-03-1997
		AU 703071 B2	11-03-1999
		AU 6881096 A	27-03-1997
		AU 703058 B2	11-03-1999
		AU 6881296 A	27-03-1997
		AU 705592 B2	27-05-1999
		AU 6881396 A	27-03-1997
		AU 703296 B2	25-03-1999
		AU 6881496 A	27-03-1997

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 01/05608

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9709842	A	AU 699890 B2	17-12-1998
		AU 6881596 A	27-03-1997
		AU 703198 B2	18-03-1999
<hr/>			